CLAIMS

1. A far-end crosstalk canceling circuit for a digital subscriber line transmission system, said transmission system comprising a plurality of line termination modems receiving discrete multitone signals from corresponding network termination modems over a plurality of transmission channels, each modem comprising time/frequency transforming means for transforming said discrete multitone signals into a discrete multitone symbol of frequency components and demapping means outputting for each frequency component the symbol of the constellation nearest thereto and the corresponding demodulated data;

estimation means, in at least one line termination modem, for estimating the constellation symbols actually sent by the network termination modems, from the frequency components of the discrete multitone symbols received by all modems;

calculation means for calculating a linear combination of said estimated modulated data, for subtracting said linear combination from the frequency components of said at least one line termination modem and for applying a resulting difference to the demapping means of said at least one line termination modem;

error calculation means for calculating the error distance between the constellation symbol from said at least one line termination modem and said difference;

updating means for updating the coefficients of said linear combination as a function of said error distance.

2. The far-end crosstalk canceling circuit of claim 1, the estimation means provides the constellation points respectively output by the demappers of the modems as estimates for the modulated data.

3. The far-end crosstalk canceling circuit of claim 1, wherein the estimation means further comprises switching means for outputting the frequency components in a first step and the constellation symbols, obtained therefrom in a second step as estimates for the modulated data.

4. The far-end crosstalk canceling circuit of claim 1, wherein:

the estimation means is common to all the line termination modems and simultaneously provides the discrete multitone symbols as estimates for consecutive

symbols;

the calculating means is common to all the line termination modems and comprises matrix calculation means calculating at time t the product $H^{-1}_{t-1}*R$ of a matrix H^{-1}_{t-1} with the vector R, R being a vector constituted by all the sets of frequency components Ri, H^{-1}_{t-1} being an estimate at time t-1 of the inverse of the transfer matrix of the plurality of transmission channels;

the error calculating means is common to all the line termination modems and calculates the error distance between each of the n components of the vector $H^{-1}_{t}*R$ and the constellation symbols output by the respective demappers of the modems;

the updating means is common to all the line termination modems and updates the coefficients of the matrix H^{-1}_{t-1} as a function of said error distance.

5. The far-end crosstalk canceling circuit of claim 1, further comprising parallel to serial converters transforming the discrete multitone symbols Ri into respective serial streams of frequency components, wherein:

the estimation means is common to all the line termination modems and simultaneously provides the frequency components as estimates for the symbols;

the calculating means is common to all the line termination modems and comprises matrix calculation means sequentially calculating at time t, for each tone j the product $H^{-1}_{t-1}(fj)*R(fj)$ of a matrix $H^{-1}_{t-1}(fj)$ with the vector R(fj) constituted by all the frequency components Ri(fj) at the frequency fj, $H^{-1}_{t-1}(fj)$ being an estimate at time t-1 of the inverse of the transfer matrix at the frequency fj of the plurality of transmission channels;

the error calculating means is common to all the line termination modems and sequentially calculates for each tone j the error distance between each of the n components of the vector $H^{-1}_{t}(fj)*R(fj)$ and the constellation points $\hat{S}$ i(fj) output by the respective demappers of the modems;

the updating means is common to all the line termination modems and sequentially updates for each tone j the coefficients of the matrix $H^{-1}_{t-1}(fj)$ as a function of said error distance.

6. A digital subscriber line transmission system comprising a crosstalk

canceling circuit according to claim 4, in which the line termination and network termination modems are of the synchronous Zipper type.

7. A far-end crosstalk canceling method for a digital subscriber line transmission system, said transmission system comprising a plurality of line termination modems receiving discrete multitone signals from corresponding network termination modems over a plurality of transmission channels, each line termination modem comprising frequency transforming means for transforming said discrete multitone signals into a discrete multitone symbol of frequency components, and demapping means outputting for each frequency component the symbol of the constellation nearest thereto and the corresponding demodulated data, the method comprising the steps of:

estimating, for at least one line termination modem, the constellation symbols actually sent by all the modems, from the frequency components of the discrete multitone symbols received by said modems;

calculating a linear combination of said estimated symbols, subtracting said linear combination from the frequency components of discrete multitone symbol and applying the resulting difference to the demapping means of said at least one modem, to obtain a constellation symbol;

calculating the error distance between said constellation symbol and said difference; and

updating the coefficients of said linear combination as a function of said error distance.

8. The far-end crosstalk canceling method of claim 7, wherein the estimation step provides the constellation symbols respectively output by the demappers of the modems, as estimates for the symbols.

9. The far-end crosstalk canceling method of claim 7, wherein the estimation step provides, as estimates for the symbols, the frequency components in a first step and the constellation symbols obtained therefrom in a second step.

10. The far-end crosstalk canceling method of claim 7, wherein:

the estimation step is carried out for all the line termination modems and provides the frequency components as estimates for consecutive symbols;

the calculation step is carried out for all the line termination modems and comprises the calculation at step t of the product $H^{-1}_{t-1}*R$ of a matrix H^{-1}_{t-1} with a vector R, R being a vector constituted by all the n DMT symbols Ri, H^{-1}_{t-1} being an estimate at step t-1 of the inverse of the transfer matrix of the plurality of transmission channels;

the error calculating step is carried out for all the line termination modems and calculates the error distances between each of the n components of the vector $H^{-1}_{t-1}*R$ and the constellation symbols output by the respective demappers of the modems;

the updating step is carried out for all the line termination modems and updates the coefficients of the matrix H^{-1}_{t-1} as a function of said error distance.

11. The far-end crosstalk canceling method of claim 7, further comprising:

a parallel to serial conversion of the discrete multitone symbols into respective serial streams of frequency components;

wherein:

the estimation step is carried out for all the line termination modems and simultaneously provides the frequency components as estimates for the symbol;

the calculating step is carried out for all the line termination modems and sequentially calculates at step t, for each tone j, the product $H^{-1}_{t-1}(fj)*R(fj)$ of a matrix $H^{-1}_{t-1}(fj)$ with the vector R(fj) constituted by all the frequency components Ri(fj) at the frequency fj, $H^{-1}_{t-1}(fj)$ being an estimate at step t-1 of the inverse of the transfer matrix at the frequency fj of the plurality of transmission channels;

the error calculating step is carried out for all the line termination modems and sequentially calculates, for each tone j, the sum of the error distance between each of the n components of the vector $H^{-1}_{t}(fj)*R(fj)$ and the constellation symbols $\hat{S}$i(fj) output by the respective demappers of the modems;

the updating step is carried out for all the line termination modems and sequentially updates for each tone j the coefficients of the matrix $H^{-1}_{t-1}(fj)$ as a function of said error distance.